

BELLCOMM, INC.

SUBJECT: Data Generation by AAP
Experiments - Task 18
Case 218

DATE: December 20, 1965

FROM: D. Basson

ABSTRACT

Mission planning in the Apollo Applications Program has advanced to the point where mission assignments for the early flights, i.e. alternate Apollo Missions, have been made. While these experiment assignments are preliminary, they do provide a basis for an initial estimate of the data load expected from these missions. The preparation of this estimate is the purpose of this memorandum.

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MEMORANDUM FOR FILE

INTRODUCTION

Mission planning in the Apollo Applications Program has advanced to the point where mission assignments for the early flights, i.e. Alternate Apollo Missions, have been made. Experiment groupings have been made for these flights drawing from MSFEB approved experiments, experiment proposals of principal investigators, as well as NASA and contractor studies. While these experiment assignments are preliminary, they do provide a basis for an initial estimate of the data load expected from these missions. The preparation of this estimate is the purpose of this memorandum.

The missions to be considered are Alternate Apollo Missions 211, 214, 215, 216, 217, 507, 509, and 511 as assigned in the AAP draft FMAP ML-65-1.

It is worth noting at the outset that the basic information used in this study is far from firm. Many of the proposals or other sources fail to provide complete information. The results presented should be viewed as best available current estimates and not as firm requirements.

EXPERIMENT DATA CHARACTERISTICS

It is possible to categorize the data generated by AAP experiments in terms which are meaningful for the operations to be subsequently performed. These succeeding processes of data storage, data transmission, data processing, data display and data evaluation make it desirable to differentiate certain classes of measurement characteristics.

Specifically, the following data characteristics can be recognized:

A. Signal Frequency Characteristics

1. wide band data ($>> 3\text{kc}$)
2. medium band data ($\sim 3\text{kc}$)
3. narrow band data ($<< 3\text{kc}$)

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B. Data Form

1. analog
2. digital

C. Normal Data Storage Media

1. paper, film records
2. electrical records (tape recording process)

D. Data Processing and Display Requirements

1. immediate processing and display desirable
2. processing and display with short time delays acceptable
3. processing and display only required long after the mission is performed.

DATA GENERATION RATES

A set of tables follows listing experiment assignments to flights for the previously mentioned early AAP flights.

One should note that these flights contain groups of experiments which deal with:

- a. biomedical signals assessing the properties of living systems
- b. spectral sensing signals assessing the earth and lunar radiation characteristics over a wide frequency range
- c. space operations and technology.

Those flights primarily composed of biomedical experiments generate modest data loads (say about 10 kbps). Requests on biomedical flights for electrocardiogram and electromyogram data can generate requirements for as many as 18 medium bandwidth, analog channels.

The heaviest data loads are developed on flights with spectral sensing equipment and biomedical experiments as well. Such flights occur on both the remote lunar and the earth sensing missions. Note that communications requirements differ in these two types of flights. This difference centers around the limited time for data transmission from 200 NM earth orbits with the presently existing ground net. For lunar orbits, line of sight transmission is possible except when the spacecraft is on the other side of the

moon from the earth. The heavy data load (for say lunar flight 511) can be estimated at roughly a 33 kbps PCM, 18 channels of analog data, and 4 wide bandwidth signals (40kc each, which might be filmed instead of transmitted).

Note should be made of requests for wide bandwidth TV in the experiment listings. These requests are prevalent in monitoring space operations.

ALLOWABLE DELAY IN TRANSMISSION OF EXPERIMENTAL DATA

There is considerable NASA interest in anticipating the allowable delays in transmitting and processing AAP experimental data. This section will review the status of present knowledge relating to this significant question.

Experiments assigned and being considered for AAP Missions contain very little mention of demands for real time data reduction. However, many of the experiment descriptions do request expert evaluation of the data to remove redundancy as well as requests for data display. These requests indicate a need to have early data runs as well as selected later runs transmitted to the control center where they could be displayed, processed, and interpreted for data validity. Such evaluations could be performed on an off line basis at the control center.

Lacking any explicit statements in available experiment descriptions stating delay times involved in the transmission of experimental data, it is only possible to indicate that the bulk of the data generated in experiments for the Alternate Apollo Missions appears not to require immediate utilization.

The spectral analysis experiments produce a special class of data, and much of this data can be usefully correlated across various different spectral regions. Once again, off line display and processing are indicated with the possibility that experimenter examination of the results may aid in improving data quality or in controlling data quantity.

One other very important class of experiments contains all those operations which affect astronaut safety. For these experiments, the data appear vital enough to the successful operation of the mission as to require immediate data transmission.

It is important to reiterate that available experiment descriptions for Alternate Apollo Missions do not contain specific references to the allowable time delays acceptable for receipt of experimental data. Thus, that processing described within this section must be considered only as reasonable inferences at the present time.

DATA GENERATION AREAS NOT COVERED BY PRESENT STUDY

Experiments will be performed in earth orbits, lunar orbits, and upon the lunar surface during the AA Program. This study has collected estimates for the data generation rates for experiments planned for the Alternate Apollo Missions. The experiments for the follow on missions have not been assigned.

The data generation rates for these later missions are obviously not available at the present time. Their existence should be kept in mind so that their impact on the AA mission plans is not neglected.

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1013-DB-crr

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Attachments

Tables 1 - 8

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TABLE I - DATA GENERATION FOR FLIGHT #2II

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND-WIDTH
	Earth's Magnetic Field Measurement	Attitude Signal Magnetometer Outputs		Common to Other Exp. 256 bps	D	N
	Radar Scattering Cross-Section of Terrain	Return Radar Signal Power	System Operated Every Other 15 Minutes. Total Time = ?	300 kc information bandwidth of pulse video transmission and recording.	A	W W
	Temperature Sounding of Atmosphere	Color Photo's, Voice Data, Time, Location, Digitized Spectrometer Data, Analog, Spectro- meter Data $\pm 1.5\%$	10 Min./observation (~ 50 Observations)	1 Color Photo/ Observation 1 channel @500 bps 1 channel 50 cps	D A	M M
	Ultra Violet Mapping of Space (1230 to 1700 A)	Photo's Angular Position	Night Portions of 2-60 Orbits	Film, 35 mm, 1000 Exposures. 3 channels (θ, ϕ, ψ) (Common) IMU Position	D	N
	X-Ray Astronomy	Spacecraft Attitude Angles (θ, ϕ, ψ)	100 Exposures Minimum. (200 Min.) (with 2 min. Experi- ment Intervals.)	3 channels @1s/s 16 Counting Units Counting Rates up to 280/sec. of 6 bit words (~ 1600 bits/sec.)*	D D	N M
	Galactic Gamma Ray Measurements	Photographs- Scanning Mode Pointing Mode		Black and White 16 mm film 1000'. Black & White (10') 16 mm Record of Each Pointing Direc- tion	-	-
	Nuclear Emulsion Measurements	Nuclear Emulsion Tracks of Heavy Primary Cosmic Radiation	NA	No Electrical Signal Data A Nuclear Emulsion Stack is Returned as Data	-	-

*Counting or Accumulating
Device Desirable to
Synchronize Data Flow.

TABLE I - DATA GENERATION FOR FLIGHT #211
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
	Atmospheric Iodine Measurements	4 Iodine Spectrometer Signals	~20 Min./Orbit # Orbits = ?	4 Channels of 100 bits/second each. (~10 s/s)	D	N
	Frog Otolith Functions in Og.	Nerve Pulse, 3 Accelerometer Signals, EKG	10 hours (30 second Recording Intervals)	8 channels of 2000 cps Bandwidth	A	M
M4	Phonocardiogram	Phonocardiogram	?	(~10cps Bandwidth)		
M5	Bioassays of Body Fluids		NA			
M7	Calcium Balance Study		NA			
M8	In Flight EEG	EEG	Continuous	Uses own miniature tape recorder-- 2 changes	A	M
M11	Cytogenetic Blood Study	NA				
M12	Exercise Ergometer	EKG Lead, Time	5-10 min. periods 3 to 4 times/ 24 hrs./astronaut	With self contained Recorder(2 channel)	A D	N N
M17	Thoracic Blood Flow	Impedance Plethysmograph	15 determinations per flight	1 channel (10s/s?)	D	N
M18	Vector Cardiogram	EKG	10 min/astronaut/ 1 day	6 channels (Analog Recording)	A	M
M19	Metabolism Study	O ₂ , CO ₂ , Flow Rate	(60 min/astronaut in selected 8 hr. periods)	6 channels @10s/s Equipment common with 0110.	D	N
M20	Mechanics of Respiration	(flow rate), (lung volume)	10 min/astronaut every 12 hrs. in flight	200 s/s 1 channel 50 s/s 1 channel	D	N
M22	Real Blood Survival	NA				
M23	Lower Body Negative Pressure		No Flight Time Requested			
0107	Venous Compliance	lower body volume, forcing pressure	1 min./3 days	1-100 s/s 2-100 s/s	D D	N N
0109	Assess Pulmonary Function	flow rate lung volume	35 min./ 7 days	200 s/s 1 channel 50 s/s 1 channel	D D	N N

TABLE I - DATA GENERATION FOR FLIGHT #211
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
0110	Ventilatory Gas Exchange	O ₂ , CO ₂ , HbO ₂ gas, volume, time	Included in 0109 time	8 channels @10 s/s 1 special 36 bit channel for time	D D	N N
0114	Gastro Intestinal Motility	gastric ph, gastric pressure	20 min./7 days	1 channel 1 s/s* 1 channel 20 s/s?	D D	N N
0121	Microbiological Assay		NA			

*Nominal sampling rate assumed.
No available information on
gastric signals.

CODE:

A = ANALOG

D = DIGITAL

FREQUENCY
TYPE { W = WIDEBAND (VIDEO)
M = MEDIUM (f < 3Kc)
N = NARROW (APPROPRIATE FOR
DIGITAL SAMPLING)

NA = NOT APPLICABLE

TABLE 2 - DATA GENERATION FOR FLIGHT #214

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
0501	Radiation Environ- ment Monitoring	"Radiation" Spectrometers	Continuous	12.5K bits/orbit with own data storage unit	D	N
0601	Capillarity Studies	Temperature, inter- face height data	6 hours	Data sheets + film		
1501	Evaluation of Space suits	Pressure, tempera- ture	4 periods of 2 1/2 hours each 2 periods of 3.5 hours each	Film 2000' 150 pictures 2000' of tape		
1502	Manned Locomotion and Maneuvering Capability		?	Film Video tape		
1503	Emergency tech- niques for rescue		?	(Motion-picture film and/or 2 video tapes per flight.)		
1504	Development of per- sonnel and cargo transfer operations		90 min/day	(Film .25 ft ³ wgt. = 2.5#) TV		

TABLE 3 - DATA GENERATION FOR FLIGHT #215

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
M5	Bioassays of Body Fluids	NA		Notes, samples and possibly some voice records.		
0118	Hemic Cell	NA				
0119	Hematalogical Defenses	NA				
0120	Hemostasis	NA				
0203	Higher Functions		19 min/ 3 days mag tape?			

TABLE 4 - DATA GENERATION FOR FLIGHT #216

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
	Control Moment Gyro	θ, ϕ, ψ spacecraft . . . θ, ϕ, ψ angles rates and associated gimbal angles to high accuracy	1 - 2 weeks experiment duration	9 channels @10 s/s	D	N
	Optical guidance system for rendezvous	Range, range rate ($\pm .03$ m/s.) Angle, angle rate, $\pm .05$ mr. Received power	2 hours/flight	5 channels @10 s/s		
	Expandable Airlock	Pressure vs. time 3 temp. vs. time Film & visual inspection	3 hours/flight	4 channels @1 s/s	D	N
1302	Deployment of R.F. Reflective Structures		20 min.	4 # of film, possible ground support with radar		
1303	Extendable Rod performance tests	Vehicle attitude Vehicle rates	6 operational periods of 6 hours each	3 channels @1 s/s 3 channels @1 s/s Visual observation & photographic film (4#)	D	N
1407	On board guidance and navigation systems	Acceleration 3 IMU angles Horizon sensor angles Sun sensor angles Star tracker Telescope angles Orbit parameters System points + mode status photos	15 orbit test sequence at 5 sec. intervals at 5 sec. intervals at 5 sec. intervals at 5 sec. intervals at 5 sec. intervals once/target fix 1 sec. intervals Data collection 20 min./orbit Net time of Experiment Approx. 1 day	3 channels @10 s/s 3 channels @1 s/s 2 channels @1 s/s 2 channels @1 s/s 1 channel @1 s/s 7 channels @5 s/s 10 channels 20 channels @1 s/s (16 bit accuracy desirable) 10-15/target	D D D D D D D D	N N N N N N N N
1601	Orbital maneuvering and docking	Sources IR Radar Optical	6 docking attempts/ flight	Pictures 12 channels @10 s/s	D	N

TABLE 5 - DATA GENERATION FOR FLIGHT #217

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND-WIDTH
M5	Bioassays Body Fluids		NA			
M8	In Flight EEG	EEG	Continuous	Uses own miniature tape recorder - 2 channels	A	M
0103	Circulatory Dynamics	blood pressure, body temp. respiration rate	1 min/ 3 days	2 channels @ 1 s/s 1 channel @ 1 s/s 2 channel @100 s/s	D D D	N N N
0104	Work Capacity	EKG	3 min/ 3 days	6 channels	A	M
0105	Blood Volume Changes		occasional voice reports	voice on mag. tape		
0106	Carotid Baroreceptors	blood pressure EKG	30 min/ 6 days	2-200 s/s channels, as in 0104 (6 channels)	D A	N M
0108	Circulatory Reflex Changes	Flow rate, lung volume	4 min/ 7 days	2-100 s/s 1-50 s/s	D D	N N
0111	Muscle Mass and Strength	Electromyogram	15 min/ 3 days	6 channels (0-200 cps) 6 channels (0-2000 cps)	A A	M M
0112	Mineral Metabolism		NA			
0113	Nutritional Status	CO ₂ O ₂	40 min/ 7 days	1 channel @ 20 s/s 1 channel @ 20 s/s	D D	N N
0117	Endocrine Function		NA			
0118	Hemic Cell		NA			
0119	Hematological Defenses		NA			
0120	Hemostasis		NA			
0201	Sensory-Perceptual		25 min/ 3 days	} mag. tape and voice		
0202	Psychomotor		5 min/ 3 days			
0203	Higher Functions		19 min/ 3 days			

TABLE 6 - DATA GENERATION FOR FLIGHT #507

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
	Lunar Mapping Camera			Checkout operations ? film wgt. <250 #		
	Lunar Sensors			Checkout operations (see flight 511 for data characteristics)		
	Synoptic Weather Photography	Time, position of exposure		Color photos of clouds and weather systems		
M5	Bioassays Body Fluids			NA		
M8	In Flight EEG	EEG	Continuous	Uses own miniature tape recorder. 2 channels.	A	M
M18	Frank Lead Vector Cardiogram	EKG	10 min./astronaut per day in resting mode	3 channels of biomedical tape recorder	A	M
M20	Mechanics of Respiration	Respirometer	10 min./astronaut/ 12 hrs. in flight	Respirometer output 1 channel @ 100 s/s	D	N
M23	Lower Body Neg. Pressure (common to 0107)	R-R rate (EKG) Blood Pressure Pressure Gauges	none in flight			
0103	Circulatory Dynamics	blood pressure body temperature respiration rate	1 min./3 days	2 channels @ 1 s/s 1 channel @ 1 s/s 2 channels @ 100 s/s	D D D	N N N
0104	Work Capacity	EKG	3 min./3 days	6 channels (0-100 cps)	A	M
0105	Blood Volume Changes		Occasional voice Reports	Voice on mag. tape		
0106	Carotid Baroreceptor	blood pressure, EKG	30 min./6 days	2-200 s/s channels, as in 1014 (6 channels analog)	D	N
0107	Venous Compliance (common to M23)	lower body volume, forcing pressure	1 min./3 days	1-100 s/s 2-100 s/s	D D	N N
0108	Circulatory Reflex Changes	flow rate, lung volume	4 min./7 days	2-100 s/s 1- 50 s/s	D D	N N

TABLE 6 - DATA GENERATION FOR FLIGHT #507
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
0111	Muscles Mass and Strength	electromyogram	15 min./3 days	6 channels (0-200 cps) 6 channels (0-2000cps)	A	M
0112	Mineral Metabolism		NA			
0113	Nutritional Status	CO ₂ O ₂	40 min./7 days	1 channel @ 20 s/s 1 channel @ 20 s/s	D D	N N
0117	Endocrine Function		NA			
0118	Hemic Cell		NA			
0119	Hematological Defenses		NA			
0120	Hemostasis		NA			
0121	Microbiological Assay		NA			
0201	Sensory and Per- ceptual Process		25 min./3 days			
0202	Psychomotor Functioning		5 min./3 days	film mag. tape, voice		
0203	Higher Mental Processes		19 min./3 days			

TABLE 7 - DATA GENERATION FOR FLIGHT #509

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND-WIDTH
	X-ray Astronomy	Spacecraft Attitude Counter Outputs	1 hour	1 analog channel for housekeeping SPACECRAFT ATTITUDE (θ, ϕ, ψ) angles ~1 s/s. Counting Rates up to 280/sec 4 bits-counter # 16 channels 2 bits-pulse ~1600 height bits/sec	D	N
	Martian Atmosphere	Spectra of Martian Radiation, Timing Marker, Spacecraft Attitude	100 min.	1 SCAN/SECOND (up to 100 mins. of data) with a 10KC bandwidth. Scans Photocathode (θ, ϕ, ψ) angles @1 s/s	A D	M N
	UV Stellar Photography	UV Photos	Video Chain desired	Pictures ?	A	W
	Artificial Comets	Photos Photometer signals	1 1/2 hours	Rapid Frame Photographs Number = ?		
	Far UV Image Converter for Stellar Astronomy	UV Photos	Astronaut Selects Targets	Integration utilizing image tube. 15 sequences of 12 pictures each station, video chain desired	A	W
0705B	Radio Astronomy (1-5 mc) (scanning mode)	Radio Signals	3 operational periods of 24 hrs. each	using smoothed outputs require 5 channels of 5 s/s each		
1001	Small Maneuverable Satellite + Magnetometer	X-ray source, measurements, solar corona structure, radio interferometer, Apollo wake, etc. Magnetic Field Components	30 min./Exp. Cycle # Experiment Cycles Unknown	50 @10 s/s (1 bit status line) 12 @10 s/s 5 @ 1 s/s	D	N
	Astronomical Experiment Orientation System (In Pallet)					

TABLE 7 - DATA GENERATION FOR FLIGHT #509
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
M5	Bioassays Body Fluids			NA		
M8	In Flight EEG			Has own tape recorder (2 channels)	A	M
0107	Venous Compliance	lower body volume, forcing pressure	1 min./3 days	1 - 100 s/s 2 - 100 s/s	D D	N N
0109	Assess Pulmonary Function	flow rate, lung volume	35 min./7 days	200 s/s - 1 channel 50 s/s - 1 channel	D D	N N
0110	Ventilatory Gas Exchange	O ₂ , CO ₂ , H b O ₂ gas volume, time	Excluded in Exp. 0109 Time	8 channels @10 s/s 1 special 36 bit channel for time	D	N
0114	Gastrointestinal Motility	gastric ph, gastric pressure	20 min./7 days	1 channel 1 s/s 1 channel 20 s/s magtape		
0115	Thermal Regulation	ear temperature	10 min. 3 times/mission	1 channel @5 s/s	D	N
0117	Endocrine Function		NA			
0118	Hemic Cell		NA		Notes, samples and possibly some voice records	
0119	Hematological Defense		NA			
0120	Hemostasis		NA			
0121	Microbiological Assay		NA			
0201	Sensory and Perceptual Process		25 min./3 days	magtape		
0203	Higher Functions		19 min./3 days	voice		

TABLE 8 - DATA GENERATION FOR FLIGHT #511

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND-WIDTH
0106	Carotid Baroreceptors	blood pressure EKG	30 min./6 days	2-200 s/s channels same equip. as in 0104 (6 channels analog)	D A	N M
0107	Venous compliance	lower body volume, forcing pressure	1 min./3 days	1-100 s/s 2-100 s/s	D D	N N
0109	Assess Pulmonary Function	flow rate, lung volume	35 min./7 days	200 s/s 1 channel 50 s/s 1 channel	D D	N N
0110	Ventalitory Gas Exchange	O ₂ , CO ₂ , HbO ₂ , gas volume, time	Included in Exp. 0109's time	8 channels @10 s/s 1 special 36 bit channel for time	D high accuracy digital	N
0111	Muscle Mass and Strength	electromyogram	15 min./3 days	6 channels (0-200 cps) 6 channels (0-2000 cps)	A	M
0112	Mineral Metabolism		NA			
0113	Nutritional Status	CO ₂ , O ₂	40 min./7 days	1 channel @20 s/s 1 channel @20 s/s	D D	N N
0114	Gastrointestinal Motility	gastric ph, gastric pressure	20 min./7 days	1 channel 1 s/s 1 channel 20 s/s	D D	N N
0115	Thermal Regulation	ear temperature	10 min. 3 times/mission	1 channel @5 s/s	D	N
0117	Endocrine Function		NA			
0118	Hemic Cell		NA			
0119	Hematological Defenses		NA			
0120	Hemostasis		NA			
0121	Microbiological Assay		NA			
0201	Sensory and Perceptual Process		25 min./3 days			
0202	Psychomotor Functioning		5 min./3 days	mag. tape, voice		
0203	Higher Functions		19 min./3 days			

TABLE 8 - DATA GENERATION FOR FLIGHT #511
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FROM	SIGNAL BANDWIDTH
Lunar Sensors	AAP Photographic Investigation	Photos	Astronaut Selects Target Areas	Film Footage = ?		
	Infrared Scanning	IR Intensity	Only over a limited number of sites	2-200bps signals; timing channel 1 s/sec. spectral emittance (4 signals) 4-40KC Video Signals (IR Imaging) 2 signals @ 1 s/s	D	N W
	Passive Microwave	Microwave Signal Intensity	Complete Moon Coverage	15 channels (4 s/s each) (~1 Kbps) 4200' Mag tape/28 day mission 10 ⁴ ft. of 70 mm film)	D	N
	Radio Frequency Reflectivity	multifrequency radio signals	~ 10 min./orbit controlled by astronaut	10 channels of max. freq. response of 10 cps + 1% (300 bps/channel)	D	N
	Radar Imaging, Altimetry and Surface State	radar	100% sampling of lunar surface initially, followed by reduced operation	2 channels (7kbps each) 100% duty cycle for first runs. mag. tape-Altimeter Signal Film Record 12#/orbit	D	M
	UV Absorption and Luminescence	UV Photos	500 frames/orbit	500 frames/orbit of 35 mm film or equivalent		
	X-Ray Fluorescence	X-Ray Flux	Continuous on Light Side of Moon	1 s/s X-Ray Flux (Analog Freq. 10 cps?)(Pen Recorder Output Desirable)	D	N
	Remote Geochemical Sensing	Vapor concentration	Take data until full coverage is achieved	10 channels 10 cps max./channel 300 bps/channel obtain planetary coverage	D	N
	Micrometeorite Exp.	micrometeorite flux	?	Particle Detector Signals = ?		

TABLE 8 - DATA GENERATION FOR FLIGHT #511
(Continued)

EXPERIMENT NUMBER	EXPERIMENT DESCRIPTION	SIGNALS	TIME REQUIRED	DATA GENERATION	SIGNAL FORM	SIGNAL BAND- WIDTH
	Lunar Gravity Measurement	gravity gradient	?	Gradiometer Signal @ 1 s/s 8 bit accuracy	D	N
	Detection of Alpha Emission from the Lunar Surface	α particle flux	continuous data obtained from pulse height analyzer	10 s/s-pulse height (1-2% accuracy) 1 s/s - ratemeter (20% accuracy)	D	N
	Gamma Ray Mapping	gamma ray flux	MAP Lunar Surface	?		
	Lunar Surface Probes	not well established	one pass/mission ?	(probe instrumentation not well established)		
0105	Blood Volume Changes		NA			
M5	Bioassays Body Fluid		NA			
M8	In Flight EEG	EEG		Has own biomedical tape recorder 2 channels	A	M
0103	Circulatory Dynamics	blood pressure, body temperature respiration rate	1 min./3 days	3 channels @ 1 s/s 2 channels @100 s/s		
0104	Work Capacity	EKG	3 min/3 days	6 channels	A	M